Kamloops Timber Supply Area

Documentation of
Vegetation Resources Inventory
Interim Ground Sample Inventory Analysis

DRAFT 1.0

PREPARED BY:
MINISTRY OF SUSTAINABLE RESOURCE MANAGEMENT
TERRESTERIAL INFORMATION BRANCH

FOREST
RENEWAL BC

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1. Executive Summary

This report documents the Vegetation Resources Inventory (VRI) preliminary analysis that was completed for the Kamloops TSA VRI Ground Sample Inventory. The material presented in this report was made available for the current Timber Supply Review (TSR) and was developed in conjunction with staff from Ministry of Sustainable Resource Management, Terrestrial Information Branch, Kamloops Region, and Ministry of Forests, Timber Supply Branch. Funding was provided by Forest Renewal. Analysis support was provided by Jahraus and Associates Ltd.

The report references and contains content from the previously developed "Kamloops TSA Vegetation Resources Inventory Ground Sampling Plan, Jan 15th 2001." A copy of this document is attached.

This analysis focused on the development of interim factors to assess the accuracy of height, age and volume attributes in the current inventory. This material was provided in order to support the current timber supply analysis.

As this study is incomplete the material presented in this report was not used to adjust the current planning files.

The process used to derive these adjustments is interim (Fraser protocol) and may change in the future. In the "Fraser Protocol", the statistical adjustment of inventory attributes consists of a set of steps and assumptions used to develop and then apply adjustment factors to the FIP file attributes of height and age and the volume predicted using VDYP. When this study is complete, the goal of the adjustment is to remove any overall bias in the inventory when compared against the VRI ground data for the attributes that are adjusted.

The steps in this adjustment process are :

1. Adjust height and age.
2. Based on the adjusted height and age, use VDYP to computed inventory volume (attribute - adjusted inventory volume)
3. Use the compiled ground volumes to then adjust the "attribute-adjusted" inventory volume.

The target population is the operable Vegetated Treed (VT) portion of the TSA, excluding private lands, Parks and other legally recognised Protected Areas, TFLs, and woodlots. Sample polygons were selected over the entire target Vegetated Treed (VT) population using stratified probability proportional to size with replacement (PPSWR) sampling, with the strata based on forest type (leading-species groups) and average polygon volume per hectare. The inventory will be implemented in number of stages. In the first stage 47 VRI sample clusters will be installed in the 2001 field season[1]. In year 2002 if funding becomes available the remaining number of sample clusters needed to obtain the objective precision level of + or _ 10% sampling error at the 95% level of probability will be established. Enhanced cruising for 38 Net Volume Adjustment

[1] This study summarizes the first year of sampling in which 49 samples were completed.

Factors (NVAF) samples will be done on the selected samples as the samples are established during the 2001 and 2002 sampling periods. The destructive sampling stage of the NVAF sampling will be done after the ground samples are established and if funds become available. The current plan indicates that in the interim the existing loss factors will be used to determine net volumes for the final analysis.

In summary the overall volume impact based on loss factors is 0.909 +/- 16% (at the 95% level of probability). Based on net factoring (without the application of NVAF), the overall volume impact in this unit is 1.002 +/- 17% (at 95%). This is based on a sample size of 49 (sample sizes among the five strata of interest ranged between 4 and 18).

2. Results

Table 1: Height Adjustment Ratios

Stratum	n	Mean grd height	Mean inventory height	Ratio of means
Fir	14	21.551	23.743	0.908
Pine	13	18.595	21.777	0.854
Balsam	4	20.75	23.75	0.874
Spruce	7	28.262	29.1	0.971
Decid/Misc	4	25.175	27.85	0.904

Table 2: Age Adjustment Ratios

Stratum	n	Mean grd age	Mean inventory age	Ratio of means
Fir	13	110.703	118.231	0.936
Pine	13	100.469	105.769	0.950
Balsam	4	131.467	152.25	0.863
Spruce	7	154.413	163.857	0.942
Decid/Misc	4	111.127	219.5	0.506

Table 3: Volume Adjustment ratios (Loss Factor) 17.5 cm+ dbh net DWB except 12.5 cm+ dbh net DWB in Pine stratum

Stratum	n	Mean ground vol/ha (loss factor)	Mean "attribute-adjusted" inventory vol/ha	Ratio of means
Fir	18	152.956	139.528	1.096
Pine	14	195.512	168.407	1.161
Balsam	4	227.418	177.6	1.281
Spruce	7	307.638	298	1.032
Decid/Misc	6	209.895	197.617	1.062

Table 4: Volume adjustment ratios (net factored only) 17.5cm+ dbh net dwb except 12.5cm+ dbh net dwb in Pine stratum

Stratum	n	Mean ground vol/ha (net factored; NO NVAF)	Mean "attribute-adjusted" inventory vol/ha	Ratio of means
Fir	18	163.936	139.528	1.175
Pine	14	213.281	168.407	1.266
Balsam	4	256.185	177.6	1.442
Spruce	7	338.556	298	1.136
Decid/Misc	6	247.71	197.617	1.253

Table 5: Volume impact (Loss Factor) 17.5cm+ dbh net dwb except 12.5cm+ dbh net dwb in Pine stratum

Stratum	n	area (ha)	% area	Mean ground vol/ha (loss factor)	Mean unadjusted inventory vol/ha	Ratio of means
Fir	18	458047.7	36%	152.956	171.244	0.893
Pine	14	326811	26%	195.512	224.764	0.870
Balsam	4	141771	11%	227.418	221.95	1.025
Spruce	7	222990.8	17%	307.638	312.443	0.985
Decid/Misc	6	129271.6	10%	209.895	271.833	0.772
		1278892.1				

Approx. sampling error @ 95% = 16.2%

Table 6: Overall Volume impact (net factoredonly with NO NVAF) 17.5cm+ dbh net dwb except 12.5cm+ dbh net dwb in Pine stratum

Stratum	n	area (ha)		Mean ground vol/ha (net factored; NO NVAF)	Mean unadjusted inventory vol/ha	Ratio of means
Fir	18	458047.7	36%	163.936	171.244	0.957
Pine	14	326811	26%	213.281	224.764	0.949
Balsam	4	141771	11%	256.185	221.95	1.154
Spruce	7	222990.8	17%	338.556	312.443	1.084
Decid/Misc	6	129271.6	10%	247.71	271.833	0.911

Approx. sampling error @ 95% = 16.6%

3. Analysis Assumptions:

This analysis is DRAFT and subject to the following assumptions/conditions:

- detailed examination of data (population of interest criteria checks, graphical inspection of raw data, residuals plots, etc.) has not been completed.
- stratum assignment was copied from the sample selection file received from TIB (Kamloops_NVAF_ALL.xls)
- utilization was assumed to be 17.5cm+ dbh net dwb for all strata except 12.5cm+ dbh net dwb for the PINE stratum.
- stratum areas (to compute combined ratio estimate) were provided by TIB. (population of interest assumed to be VT, typeid 1,2 or 3, ownership 61C, 62C, 69C, 90C)
- overall impact ratio and sampling error were computed using formulae for combined ratio estimator after a pre-stratified PPSWR sample as provided by MoF Research Br. (note: z-value of 1.96 was assumed... sampling error based on Cochran's "effective degrees of freedom" may be slightly higher).

Kamloops Timber Supply Area

Timber Emphasis VRI Ground Sampling Project Implementation Plan

PREPARED BY:
MINISTRY OF FORESTS
KAMLOOPS FOREST REGION

15 JANUARY 2001

Executive Summary

This is a VRI Project Implementation Plan (VPIP) for the timber emphasis VRI in the Kamloops Timber Supply Area (TSA). The target population is the Operable Vegetated Treed (VT) portion of the TSA, excluding private lands, Parks and other legally recognized Protected Areas, TFLs, and woodlots. Sample polygons will be selected over the entire target Vegetated Treed (VT) population using stratified probability proportional to size with replacement (PPSWR) sampling, with the strata based on forest type (leading-species groups) and average polygon volume per hectare. The inventory will be implemented in number of stages. In the first stage 47 VRI sample clusters will be installed in the 2001 field season. In year 2002 if funding becomes available the remaining number of sample clusters needed to obtain the objective precision level of + or _ 10% sampling error at the 95% level of probability will be established. Enhanced cruising for 38 Net Volume Adjustment Factors (NVAF) samples will be done on the selected samples as the samples are established during the 2001 and 2002 sampling periods. The destructive sampling stage of the NVAF sampling will be done after the ground samples are established and if funds become available. During the interim the existing loss factors will be used to determine net volumes for the final analysis.

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1. INTRODUCTION

a. Background

This VRI Project Implementation Plan (VPIP) outlines ground sampling activities for the timber emphasis VRI in the Kamloops TSA. The priority is on the Operable land base within the Vegetated Treed land base. The Ministry of Forests (MOF) Kamloops Forest Region and Resources Inventory Branch (RIB) prepared this VPIP in consultation with the Ministry of Forests Regional and District staff. This VPIP is based on the Kamloops and Clearwater Forest District Inventory Plan completed in June 1998. A glossary of terms is provided in Appendix A.

b. Rationale

This timber emphasis VRI is motivated by the Kamloops Region and District to verify and adjust the newest inventory completed since the last Audit.

sampling plan

c. Overview

The information in this section is presented here for easy reference, and includes description of the landbase, inventory objectives, target population, sample size and selection, and the VRI tools to be used.

d. Landbase

The Kamloops TSA is approximately 2,094,647 ha. Approximately 1.8 million ha of the TSA area is Crown forest (Table 1). The remainder is private land, reserves, and parks. The main tree species in the TSA is fir (35%), pine (27%), spruce (19%), balsam (10%), cedar (3%), hemlock (2%) and deciduous (4%) (Table 2).

Table 1. Kamloops TSA Crown Forest Land.[2]

Land Classification	Area (ha)	%
Immature	576,180	31
Mature	824,969	45
Not Stocked	53,970	3
Non Commercial	2,512	0
Non-Forest	381,028	21
No Typing Available	29	0
Total	*1,838,689*	*100*

[2] Excludes private land, TFLs, woodlots, and parks and other protected areas. Data from the forest inventory planning (FIP) file used for TSR II provided by the District.

e. Inventory Objectives

The main objective of the timber emphasis inventory is to:

> *Install an adequate number of VRI sample clusters to adjust the timber inventory in the Operable part of the Crown Vegetated Treed (VT) areas, to achieve a sampling error of ±10% (95% probability) for overall net timber volume in the Operable Crown VT areas.*

Table 2. Kamloops TSA Crown Forested Landbase by Species

Leading Species	Area (ha)	%
Fir	447,780	34.9
Pine	355,765	27.7
Spruce	249,796	19.4
Balsam	123,834	9.6
Cedar	44,430	3.5
Hemlock	29,435	2.3
Larch	141	0.0
Deciduous	53,208	4.1
Total	*1,304,387*	*100.0*

*Alder, larch and white bark pine

Net timber volume is gross volume minus stumps, tops, decay, waste, and breakage. Decay and waste are normally estimated using VRI call grading/net factoring and NVAF sampling. In the preliminary analysis, the 1976 MOF Forest Inventory Zone Decay, Waste and Breakage factors will be used to net down gross merchantable volume. NVAF sampling will be done as future funds are identified.

f. Target Population

The target population is the Crown Operable VT portion of the TSA, which includes ownership 61,62,69 and 90 for only Type Identities 1 to 3 (Immature and Mature). The MOF Resources Inventory Branch official file will be sampled. According to this file, the target population Crown VT area is 1,284,757 ha. based on FIP files and not the VRI Retrofitted Portion of Kamloops District.

g. Sample Size

To meet the inventory objectives (section 2.3), a sample size of 150 VRI sample clusters is
recommended.

Table 3. Sample cluster distribution in the Immature and Mature Crown VT Landbase.

Landbase	Area (%)	Number of clusters
Operable	92	150
Remaining areas	8	13
Total	*100*	*163*

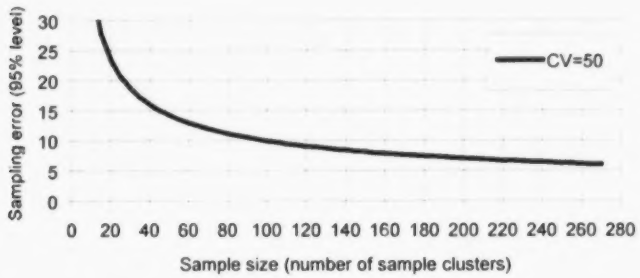

Figure 1. Decreasing sampling error with increasing sample size.[3]

h. Sample Selection

The Resources Inventory Branch selected sample polygons using the new stratified probability proportional to size with replacement (PPSWR) sample selection method. Stratification was based on leading species and polygon volume per hectare. Sample allocation to individual leading-species strata and substrata was proportional to strata or sub-strata areas. PPSWR was applied to each sub-stratum. Comparison of the VT population and the sample proportions is provided in Appendix E. Additional batches were also selected in case there is a need to increase sample size or replace some of the samples.

i. Measurements

VRI certified crews will be used to gather data – measure timber attributes and Succession Interpretations (EO) - following the current VRI *Ground Sampling Manual*. The following Card Types will be used: 1-3, 8-11 and 16.

j. Net Volume Adjustment Factor Sampling

This sampling will be done if funding becomes available. NVAF sampling involves detailed stem analysis of sample trees, calculation of actual net volume, and calculation of the ratio between actual net volume and estimated net volume (where estimated net volume is obtained from net factoring and taper equations). One hundred and forty trees will be selected from 38 VT polygons (selected with at random from the Phase II sample clusters) would typically selected in the VT target population and destructively sampled for NVAF. This will provide a sample of 30 immature trees, 80 mature and 10 dead trees to represent the CH, Fir, Pine and SB stratas.

[3]The CV, or coefficient of variation, is estimated from the inventory audit data.

k. Within Polygon Variation Sampling

No WPV sampling is planned at this time. WPV sampling provides information to estimate individual polygon error, assessed as the difference between adjusted polygon value and "true" value for that polygon based on intensive sampling of sample polygons.

Implementation PLAN

l. Overview

- Year 2001 47 timber emphasis VRI sample will be established. The remaining samples will be installed in 2002 or subsequent years. The samples will be established in such a manner that at the end of the 2001 field season a valid sample will have been completed.

m. Schedule

The VRI will be implemented in 2001 as follows:

1. Prepare and submit a VPIP (this Plan) for approval by the Resources Inventory Branch (RIB).
2. RIB will select 500 sample polygons from the VT land base with 38 samples identified as NVAF (8 samples in immature and 30 in mature stands).
3. Kamloops Regional VRI Specialist will prepare a Standards Agreement and the associated Schedule 'A'.
4. Lead Proponent will hire a Certified VRI Contractor to do the 2001 work as stated in this plan.
5. Contractor will prepare sample packages as per S.A. in 3) above..
6. The resulting digital sample files will be supplied to RIB to Ministry of Forests Standards for compilation and quality control.
7. Kamloops Regional VRI Specialist will do any necessary preliminary analysis necessary.
8. 10% Quality Assurance will be done on the field work.
9. RIB will analyze the resulting ground data if funds are available.

n. Schedule

Year 2001 – establishment of 47 Ground Samples, 17 will be cruised for NVAF..
Year 2002 – establishment of the remaining necessary Ground Samples and complete the NVAF cruising on another 21 samples.
Year 2003 – NVAF destructive sampling – 140 trees.
Year 2004 – Analysis and adjustment of the inventory.

o. Sample Packages

As per Schedule 'A'.

p. Project Support

As per Schedule 'A'.

q. Fieldwork

As per Schedule 'A'.

r. Quality Assurance

Quality assurance will be conducted. The VRI quality assurance standards require inspection of at least 10% of the samples. The field crews are responsible for the quality control of their own work.

s. Data Compilation, Analysis, and Adjustment

The Resources Inventory Branch will complete data compilation; contract field crews will do data entry. The Resources Inventory Branch will also complete the statistical analysis and database adjustment.

t. Roles and Responsibilities

Ministry of Forests
The MOF will:

- Select the sample polygons (Resources Inventory Branch).
- Select sample locations within polygons (Kamloops Forest Region).
- Prepare all sample packages (Contractor)
- Mentor NVAF crews (Kamloops Forest Region & RIB).
- Conduct NVAF quality assurance (Kamloops Forest Regional).
- Check data after initial compilation (Kamloops Forest Region).
- Validate and compile data (Resources Inventory Branch).
- Provide attribute files and minimum standards for statistical analysis (Resources Inventory Branch).
- Prepare and sign-off Standards Agreement and Schedule A (Kamloops VRI Inventory Specialist).
- Award fieldwork contracts (Lead Proponent)
- Provide mentor for field crews at the start of fieldwork. (Kamloops Forest Region & RIB).
- Coordinate project activities (Kamloops Forest Region).
-

Field work contractors

- Complete field sampling.
- Conduct internal quality control.
- Enter the sample data.

Check-cruiser (Contractor)

- Insure QA work for 10% of the VRI samples.

u. Approximate Costs

Estimated sample sizes and costs in Table 4. The estimated total cost for sampling the operable VT stratum, including the NVAF sampling, is $234,600.

Table 4. Estimated minimum sample sizes and costs for the timber emphasis VRI in the Kamloops TSA.

VRI Activity	Sample size (clusters)	Unit Cost($)	Total Cost ($)
Sample Clusters	150	1,200	180,000
NVAF cruising [4]	38	200	7,600
NVAF destructive sampling	140	300	42,000
Statistical analysis[5]			5,000
Total			*234,600*

v. Monitoring

The RIB is responsible for monitoring this VPIP and its approval (Appendix F).

[4] This NVAF sampling will contribute to calculation of an overall NVAF for the entire VT population. If stand-alone NVAF factors are needed for the spruce stratum, then additional sampling may be required.
[5] The Region and District should allow contingency funds in the budget to cover this project item. The Resources Inventory Branch is committed to doing the statistical analysis in-house or on contract (although the 2000/01 budget is uncertain at this time).

Appendix a – Glossary of Terms

District-wide VRI
This is synonymous with provincial VRI; see Provincial VRI.

Ground Sampling
Ground sampling is the field measurement of timber, ecology, range, and/or coarse woody debris values at one or more locations within each sample polygon. Sample polygons are selected proportional to their area from a sorted list. To accommodate a wide variety of resources, various types and sizes of sampling units (e.g., fixed and variable plots, transects) are used to make the measurements.

Inventory Unit
An inventory unit is the target population from which the samples are chosen. For the provincial VRI, the inventory unit is the Forest District, which includes the timber harvesting landbase, parks, recreational areas, private, and federal lands. For management inventories, the inventory unit is a subset of the provincial VRI inventory unit that focuses on a geographic area or specific attribute set, depending upon sampling objectives.

Landcover Classification
The BC Land Cover Classification Scheme (BCLCS) was designed specifically to meet VRI requirements, in addition to providing general information useful for "global vegetation accounting" and "integrated resource management." The BCLCS is hierarchical and reflects the current state of the landcover (e.g., presence or absence of vegetation, type and density of vegetation) and such fixed characteristics as landscape position (i.e., wetland, upland, alpine). There are two main classes of polygons: Vegetated and Non-Vegetated.

Management VRI
Management VRI are specialized inventories that provide detailed information required for specific resource management, i.e., day-to-day forest management. One or more VRI sampling procedures may be used for management inventories. Management inventories may focus on specific resource types (e.g., timber, range, ecology), geographic areas (e.g., landscape unit, TFL), attribute sets (e.g., Douglas-fir leading stands, age class 4+). They may use one or more of the following tools (e.g., photo-interpretation, ground sampling, NVAF sampling).

National Forest Inventory (NFI)
The NFI provides information on Canada's resources across all provinces and allows the Federal Government a consistent framework for reporting on Canada's inventory. The inventory unit for the NFI is the entire country, although it is implemented province-by-province.

Net Volume Adjustment Factor (NVAF) Sampling

NVAF sampling provides factors to adjust net tree volume estimated from net factoring and taper equations. The adjustment accounts for hidden decay and possible taper equation bias. NVAF sampling involves detailed stem analysis of sample trees, calculation of actual net volume, and calculation of the ratio between actual net volume and estimated net volume (where estimated net volume is obtained from net factoring and taper equations).

Photo-Interpretation

Photo-interpretation involves subjective delineation of polygons and photo estimation of attributes for all polygons in an inventory unit. Medium scale aerial photographs (1:15,000) are most often used in photo-interpretation. However, if existing photo-based inventory is acceptable, the database can be translated into VRI format and upgraded to include the additional VRI attributes.

Post-Stratification

Post-stratification involves dividing inventory unit into mutually exclusive sub-populations (strata) *after* ground sampling has been completed. Samples that fall in each post-stratum are analyzed separately and the results are applied to the corresponding population post-strata to improve the precision of the inventory's overall averages and totals.

Pre-Stratification

Pre-stratification divides an inventory unit into mutually exclusive sub-populations (strata) *before* ground sampling to provide estimates for specific areas, or to increase the confidence in the overall estimates by considering special characteristics of each stratum.

PPSWR (Probability Proportional to Size With Replacement)

This is a sample selection method in which samples (polygons) are selected with probability proportional to their size. That is, the larger polygons have a higher chance of being included in the sample.

Provincial VRI

The provincial VRI provides baseline data for provincial inventory reporting, monitoring, and research. All sampling procedures from the VRI toolbox are used for this inventory at the Forest District level. The databases generated from each District inventory will be compiled to create the provincial VRI database. The provincial VRI has also been referred to in the past as the District VRI.

Resource-Specific Interpretations

Resource-Specific Interpretations (RSI) use the Resource Inventory Committee (RIC) standard VRI baseline data products (provincial VRI or management inventory), in combination with other data sets and analysis (outside of that required to produce VRI), to produce information to address specific-resource management issues (e.g., TSR

review, important ecosystems, important habitats). These interpretations include ecosystem interpretations and habitat interpretations.

Retrofit

Retrofitting is the process of translating and upgrading an existing photo-based inventory to VRI standards. If the polygon linework and attributes are of acceptable quality, the existing FIP (Forest Inventory Planning) databases are translated to VIF (Vegetation Inventory Files) databases and the additional attributes required by the VRI are re-estimated from aerial photographs.

Sample Size

The sample size for an inventory is the minimum number of ground samples to be established in an inventory unit to meet the target precision.

Statistical Analysis

Statistical analysis is the process of adjusting the values of the photo-interpretation variables using ground sampling observations. For each sampled polygon, ground observations are compared to photo-estimated values to develop an adjustment factor. This factor is then applied to all polygons in the photo interpretation database to produce the final adjusted database.

Sub-unit

Sub-unit describes the inventory unit of a management inventory (i.e., the management inventory target population is a subset of the provincial VRI inventory unit). A sub-unit may be defined by a specific geographic area (e.g., operable landbase) or stand type (e.g., problem forest types) within the Forest District.

Target Precision

Target precision expresses the amount of variation in key attributes (e.g., timber volume) desired in the final results. Target precision, usually expressed as the coefficient of variation (CV), is used to calculate the minimum sample size for subsequent ground sampling.

Vegetation Resources Inventory (VRI)

VRI is an improved vegetation inventory process for assessing quantity and quality of BC's vegetation resources. The VRI process is designed to include a flexible set of sampling procedures for collecting vegetation resource information. The VRI is essentially a toolbox of procedures, which include:

- *Photo-interpretation*: the delineation of polygons from aerial photography and the estimation of resource attributes.
- *Ground sampling*: the establishment of plot clusters in selected polygons to measure timber, ecological, and/or range attributes.
- *NVAF Sampling*: stem analysis sampling of individual trees for net volume adjustment.

- *WPV Sampling*: intensive sampling of selected polygons to determine the error between the estimated attribute values and the "true" attribute values.
- *Statistical Adjustment*: the adjustment of the photo-interpreted estimates for all polygons in an inventory unit or management unit using the values measured during ground sampling.

The VRI can be deployed over the entire province (provincial VRI) measuring timber and non-timber resources, or over a large management unit (management VRI) measuring selected resources in specific portions of the landbase. The VRI sampling process produces spatial and non-spatial databases that can be used in multiple resource management applications including timber, ecosystem, and wildlife habitat management.

Within Polygon Variation Sampling

WPV sampling provides information for expressing the true individual polygon error, assessed as the difference between the adjusted polygon value and the "true" value for that polygon. The "true" value for the polygon is an estimate derived from a small sample of polygons that are intensively sampled on the ground.

appendix b - Sample Selection

The data inventory data (population list) for the Kamloops TSA was generated by RIB. Gary Johansen supplied the sample list to the VRI Inventory Forester in the Kamloops Forest Region..

APPENDIX C – LIST OF 47 SAMPLE POLYGONS FOR 2001 SAMPLING YEAR.

Sample No.	Species Class	Area (ha)	BCLCS	Map No.	Polygon No.
1	FIR	43.4	VTUTMOP	092I088	463
2	PINE	94.3	VTUTMDE	092P018	845
3	PINE	14.5	VTUTMOP	092P038	618
4	SPR	72.7	VTUTMOP	092M031	15
5	BAL	112.8	VTUTMOP	082M023	174
6	FIR	13.8	VTUTMOP	092I067	163
7	PINE	22.6	VTUTMDE	082D044	57

8	PINE	9.5	VTUTMOP	092P039	1192
9	PINE	20.0	VTUTMOP	092I038	48
10	FIR	21.6	VTUTMOP	092I058	718
11	SPR	18.6	VTUTMOP	092P018	337
12	BAL	23.3	VTUTMSP	082M023	530
13	FIR	18.8	VTUTMOP	082M061	546
14	FIR	9.6	VTUTMDE	092P040	586
15	SPR	15.7	VTUTMSP	092I048	31
16	FIR	21.9	VTUTMSP	092I093	565
17	SPR	28.9	VTUTMOP	082D004	629
18	DECID-MISC	19.2	VTUTMOP	083D014	374
19	FIR	43.8	VTUTMOP	092I094	236
20	PINE	33.5	VTUTMOP	082M034	94
21	FIR	15.8	VTUTMOP	082M063	102
22	FIR	64.2	VTUTMSP	092I076	335
23	PINE	214.7	VTUTMOP	092I055	489
24	DECID-MISC	3.1	VTUTMOP	092I097	15
25	PINE	42.4	VTUTMOP	092I064	170
26	BAL	302.8	VTUTMOP	082M042	327
27	SPR	29.3	VTUTMSP	082M045	418
28	PINE	17.3	VTUTMSP	092I087	840
30	SPR	50.1	VTUTMOP	082M061	528
32	PINE	86.6	VTUTMOP	092I070	248
33	FIR	9.3	VTUTMOP	082M023	1603
34	FIR	30.6	VTUTMOP	082L071	516
35	DECID-MSC	58.5	VTUTMOP	082M041	687
36	SPR	25.9	VTUTMOP	082M013	533
37	FIR	23.0	VTUTMOP	092I076	380
38	FIR	30.8	VTUTMOP	082L071	520
39	DECID-MSC	97.8	VTUTMSP	083D045	322
40	DECID-MSC	25.4	VTUTMSP	083D044	200
41	FIR	30.6	VTUTMOP	082M054	162
42	PINE	33.3	VTUTMDE	092I090	508
43	BAL	35.9	VTUTMOP	083D003	655
44	SPR	18.2	VTUTMOP	092I072	1070
47	FIR	59.2	VTUTMSP	092P030	789
48	DECID-MSC	35.2	VTUTMSP	082M023	34
49	FIR	16.5	VTUTMSP	092I100	78
50	FIR	13.1	VTUTMOP	092I068	209
51	PINE	46.0	VTUTMSP	082M083	37

Appendix D - COMPARISON BETWEEN the POPULATION AND the SAMPLE POLYGONS

Comparison of Sample and Population Polygon area distribution by Age Class.

Age Class	No. of Samples	Percent by Area	Percent of Sample List	Percent Difference	Area
1	1	8.3	0.8	7.6	108,680.9
2	0	4.8	0.0	4.8	62,249.3
3	3	3.4	2.3	1.1	43,968.8
4	12	9.0	9.4	-0.2	117,322.6
5	22	11.8	17.2	-5.0	154,063.0
6	26	17.2	20.3	-3.5	223,747.0
7	23	14.7	18.0	-3.6	192,365.9
8	30	23.1	23.4	-0.6	300,950.5
9	11	7.7	8.6	-0.7	101,039.5
TOTAL	128	100	100		1,304,387.6

Comparison of Sample and Population Polygon area distribution by Site Class

Site Class	No. of Samples	Percent by Area	Percent of Sample List	Percent Difference	Area
5	1	1.8	0.8	1.0	22,962.7
10	30	23.3	23.4	-0.3	304,112.3
15	66	49.6	51.6	-1.5	647,284.1
20	27	21.8	21.1	0.4	284,517.5
25	4	3.2	3.1	0.2	42,274.1
30	0	0.2	0.0	0.2	2,771.2
35	0	0.0	0.0	0.0	460.6
40	0	0.0	0.0	0.0	5.1
TOTAL	128	100	100		1,304,387.6

Comparison of Sample and Population Polygon area distribution by Leading Species

Leading Species	No. of Samples	Percent by Area	Percent of Sample List	Percent Difference	Area
Balsam	10	9.5	7.6	1.9	123834.2
Cedar	4	3.4	3.1	0.4	44430.0
Deciduous	5	4.1	3.8	0.3	53207.5
Fir	48	34.3	36.6	-2.3	447780.1

Hemlock	5	2.3	3.8	-1.6	29434.6
Larch	0	0.0	0.0	0.0	140.6
Pine	36	27.3	27.5	-0.2	355764.8
Spruce	23	19.2	17.6	1.6	249795.8
TOTAL	131	100	100		1304387.6